AF

IFW 1731

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants	:	Frank Filser et al.	Confirmation No.: 1826
Serial No.	:	09/623,268	
Filed	:	August 30, 2000	
TC/A.U.	:	1731	
Examiner	:	J. M. Hoffmann	
Docket No.	:	00-497	
Customer No.	:	34704	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

APPEAL BRIEF

Dear Sir:

This is an appeal to the Board of Patent Appeals and Interferences from the final rejection of claims 16-34 and 41-43 dated July 21, 2006, made by the Primary Examiner John Hoffmann in Tech Center Art Unit 1731.

REAL PARTY IN INTEREST

The real party in interest is Eidgenossische Technische Hochschule Zurich Nichtmetallische Werkstoffe, a Corporation of Switzerland.

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellants' legal representative, or assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 16-34 and 41-43 are on Appeal and are attached hereto as Appendix A.

STATUS OF AMENDMENTS

There was no amendment filed after the final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

All references made in the instant Appeal Brief will be made with reference to the Substitute specification filed at the U.S. Patent and Trademark Office on April 30, 2004.

[0001] The invention relates to a process for production of an artificial tooth substitute which can be fitted on at least one preprepared dental stump, where taking into account the shrinkage, on the basis of a model, a fully ceramic skeletal structure of biologically compatible material is calculated, produced from a blank by material removal, dense-sintered and a coating applied. See paragraph [0001]. The object of the present invention is to provide a process which allows the production of fully ceramic tooth crowns and/or tooth bridges with a skeletal structure of dense-sintered, high strength ceramic for fitting and adhesive and/or retentive fixing on natural or artificial dental stumps. The process allows the production of tooth crowns and/or bridges with occlusal and cavital surface of materials which shrink on sintering, which have a perfect fit even with a filigree form, i.e. require no further work. Furthermore, a blank of oxide ceramic material is provided which allows a simple precise performance of the process. See paragraph [0005]. The object of the present invention is achieved by the process of the present invention wherein a three-dimensional outer and inner surface of a positive model of the skeletal structure for tooth crowns and/or

tooth bridges are scanned and digitised, the data enlarged linearly in all directions by an enlargement factor f compensating precisely for the sinter shrinkage, transferred to the control electronics of at least one processing machine for machining the blank of porous ceramic and suitable tool paths derived from this, temporally decoupled from digitisation, by means of control commands for tools, material is removed from a blank until the enlarged design form of a positive model is achieved which is then dense-sintered to the skeletal structure with precise end dimensions, and then individualised by facing with a coating material of porcelain or plastic. Se paragraph [0006]. In accordance with the critical feature of the present invention, the dimensions of the surface of the skeletal structure model are enlarged linearly in all directions to compensate for shrinkage on sintering. The enlargement factor f is derived from the relative density ρ_R of the preproduced blank and the achievable relative density ρ_S after sintering according to equation 1

$$f = 3 \quad \frac{\rho_S}{\rho_R} \qquad (1)$$

See paragraph [0020]. An example of the present invention is clearly described and set forth in the instant specification in paragraphs [0036] through [0041].

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

There is a single ground of rejection to be reviewed on appeal and that is the rejection of claims 16-34 and 41-43 under 35 U.S.C. 103 (a) as being unpatentable over Wohlwend, U.S. Patent No. 6,106,747 in view of Appellants' submitted Exhibit A,

the John Halloran letter dated April 6, 2004, submitted by Appellants on May 3, 2004.

ARGUMENT

Appellants respectfully request the Board of Appeals to reverse the rejection of claims 16-34 and 41-43 under 35 U.S.C. 103 as being unpatentable over Wohlwend 6,106,747 in view of Applicant's Exhibit A, the John Halloran letter submitted to the Patent Office on May 3, 2004.

Appellants find it amazing that the prosecution of the instant application has ranged from a starting point of "insufficient disclosure" to a now entered rejection based on "obviousness". The history of this application is actually quite telling.

On June 16, 2003 Examiner Fiorilla states on Page 2 second paragraph of his office action that "the specification does not enable one skilled in the art to make or use the invention because in order to make or use the invention one must determine the enlargement factor, which can not readily determined because there is no teaching how to determine the achievable relative density after sintering". Mr. Fiorilla is a materials scientist, and graduated at Penn State where Dr. Messing was one of his teachers in ceramic matters.

In response to this rejection Appellants submitted as exhibits three letters from experts, Dr. Messing, Dr. Sigmund, and Dr. Halloran, all of which were contrary to the opinion of Mr. Fiorilla and all indicated that the instant disclosure was sufficient to allow one skilled in the art to make and use the invention.

Now, a reading of the last office action issued February 23, 2006 indicates that the current examiner believes the

invention to be disclosed in the Wohlwend patent. The Wohlwend patent was previously considered, applied by Examiner Fiorilla, and withdrawn as being state of the art after submission of arguments by Applicant's representative. Thus, prior art which was previously removed is now being applied, in hindsight, as a teaching for the instant invention. It appears that we have now come full circle and in four years are back to the rejection originally made by Mr. Fiorilla and already withdrawn by him.

The current office action now states that the Halloran letter (which was filed at the U.S. Patent and Trademark Office over two years ago) now forms a basis of a new grounds of rejection with Wohlwend. It is hard to believe that a letter which states that the instant application has sufficient disclosure to enable one to make and use the invention described can be said to raise a new ground of rejection with regard to a cited patent document which was previously discussed and removed as a reference. However this is the case.

The current examiner now cites two parts of the Wohlwend patent application, column 3 lines 24-42 and column 4 lines 51-54. Let us look to the actual teachings of the Wohlwend patent.

Wohlwend solves a problem of deformation and susceptibility to cracks (especially the fine margins) during a final sintering step (col. 1 lines 66-67, and col. 2, lines 1-22). He especially concludes that this is the major problem associated with the fabrication of dental restorations and its affiliated processes using presintered members and sequently sintering this. Hence, he teaches the use of a "working stump or a work pack possing a shrinkage factor which is basically equal to that of the reconstructive material". This stump or pack might stabilize the reconstruction during subsequent treatment. Therefore the reference given by the patent examiner encompasses only a portion of the Wohlwend patent which he chose in

hindsight after the benefit of studying the present invention. Wohlwend's procedure of preparing a working stump or a working pack with "basically equal shrinkage factor" is not needed according to the present invention. Hence our procedure is much simpler than Wohlwends. Wohlwend makes mandatory use of the working stump / pack, and sintering the combination of both.

Wohlwend's abstract states that the working stump and working pack are produced "such that they are enlarged by a predetermined enlargement factor". This is the factor that is given in table in col. 5 lines 15 to 25. Furthermore, in the abstract, Wohlwend clear emphasis to sinter the combination of form (framework) AND working stump or working pack. He states the need of a basically equal shrinkage factor of the working stump or the working pack to the form (framework). In view of this need, his enlargement factors given in the table may make sense. For an approximate enlargement factor like for Wohlwends working package, guessing or ouiji board (Examiner's statement in patent office action Jan 10th, 2005, at page 3) might work. In contrast the instant application is based on the enlargement factor compensating the sintering shrinkage Wohlwend's table does not discuss or give sufficient teaching.

Wohlwends uses the "basically equal to that of the reconstructive material" (for example col. 2, lines 14 to 16). Wohlwend also uses a preparation of the working stump and working pack given in col. 4 lines 10 to 32 where he mixes water, acid, alcohol and the shavings to a paste. Using the knowledge that different materials of initial density densify differently the patent office can guess that this support will not work. However Wohlwend never linked the shrinkage to density.

The Examiner very clearly interprets Wohlwend's patent in view of the instant application as in neither of patent

officer's citations of Wohlwends patent (col. 3, lines 24-42 and col. 4 lines 51-54) a final sintering step is mentioned nor it is mentioned a sintering of the enlarged framework to final dimensions.

The Examiner derives nicely the enlargement factor, page 5, which was said to be insufficiently disclosed in 2003. His mathematical derivation uses the teaching of the instant application to <u>enlarge linearily</u> as this is <u>not</u> disclosed by Wohlwend.

The Examiner makes use of the instant disclosure and teachings to interpret Wohlwend. First of all, Wohlwend observes when working with presintered ceramics a fracture or a deformation especially at the thin margins during the sintering step. Controlling sintering process by the working packing is his invention, col. 4 lines 32 to 45. He solves this problem by protecting the form (framework) and teaches to a time consuming procedure of producing a working stump or working package of the same shrinkage as the form (framework), and after sintering separating crown from that said working stump / pack. It is obvious that Wohlwend's procedure is much more complicated and the present invention uses a simplified procedure during sintering. The examiner assumes that Wohlwend is sintering to final dimensions using an rough enlargement factor and embedding the form (framework) in a working package / stump that during sintering imposes already deformation due to different sintering behavior (kinetics and or slightly different shrinkage). The present invention establishes a procedure using sintering without working stump and package showing no deformation or fracture at the fine margins.

Prior to the present invention those skilled in the art (as stated by Wohlwend) believed that the thin portions shrinks

differently during sintering than the bulk parts, and thus result in deformations and fractures. This proved to be untrue.

The Examiner states that Wohlwend teaches an enlargement factor. However the only enlargement factor that Wohlwend refers is a "predetermined enlargement factor" which is in table col. 5 lines 15 to 25, and which is very rough given ("enlargement factor (ca)"). Wohlwend states that the enlargement factor is dependent on the pretreatment and only shows the temperature. Wohlwend doesn't give any hint on how to determine an enlargement factor which is central for his working stump or package nor a link to "density". If Wohlwend had made the link of enlargement factor to density he might have observed that the working stump or package produced using his procedure has a different shrinkage /enlargement as it's density is much different.

The examiner also assumes that Wohlwend teaches how to apply the enlargement factor. We can't find any teachings in the Wohlwend patent supporting this assumption of the examiner on how to apply the enlargement factor. However, in the present invention as claimed it is stated "enlarging the obtained data linearily in all directions by the enlargement factor (f) and thereby compensating precisely for the sinter shrinkage".

The examiner also assumes, unsupported by any part of Wohlwend patent, that it is sintered to a controlled final density. In contrast, Wohlwend states that the working pack still has remaining porosity. Is that remaining porosity the same as for the form so that they shrink in same manner and have the same enlargement factor? Wohlwend never teaches what final density his forms and working stump and pack are sintered too. Therefore, the interpretation of the examiner is misleading as to what Wohlwend is disclosing. Wohlwend never discloses the type of enlargement that he intends to use. In the present

invention it is disclosed and claimed a "linear enlargement in all direction".

The examiner overlooks that Wohlwend never discloses determination of an enlargement factor according to the special blank. However the present invention specifies to use an enlargement factor specified for the special blank. The present invention states to use an enlargement factor calculated per blank. There is no teaching for this in Wohlwends patent. Any interpretation of Wohlwends in this direction is based on the knowledge based on our patent application.

The examiner interprets the letter of Professor Dr. J. Halloran in view of the instant invention and Wohlwend's patent. First of all, after reading the patent application for the present invention, Professor Halloran states most importantly that "the enlargement factor as defined in the patent application, is specified well enough for one skilled in the art to make use of the invention."

Appellants never said that enlargement factors were not known or used in ceramic art. That ceramic shrinks during the final firing is well known for more than 1000 years. Hence ceramic engineers take enlargement factors into account so that they do not have too small a component after sintering. Moulds, tools are used in massproduction and here components after sintering having allowance on the exact measure. Mass production also has, as stated by Halloran, the challenge of reproducibility of the dimensions and therefore cautions aims to control starting density. Halloran says that density determination is in the art of ceramicist enlargement. Halloran doesn't specify how to calculate from initial and final densities <u>AND enlarge linearily</u>.

Dental crowns are individually and sintered to final dimensions (!) and are not dealt with mass produced good where

we would have to change moulds or tools or cnc programs we do not need to control the initial density and the shrinkage. The invention approach is to measure the initial density as a means to enlarge and we do it for sake of precision on each blank! Halloran states that in order to get reproducibility of dimensions of the finished article one needs to control starting density. This is done in mass production where you have expensive moulds - however in production of individual goods in accordance with the present invention, we live with the starting density and take starting density into the calculation of enlargement factor.

Halloran and Wohlwend did not state that there are a lot of complicated models to calculate enlargement before sintering and distortion during sintering - especially before fabrication of any moulds these models are used, eg. FEA simulations. Or in massfabrication in lots of cases there is an allowance to do a final machining step in the dense sintered state. However in the present invention a simple calculation of enlargement is used which was found to work in dental application, and which gives the final dimension without need of machining in the dense sinter state. The Examiner interprets Halloran and Wohlwend in view of the present invention, especially when he states in his action on page 5, "it is deemed that the only possible computation that Halloran could have been referring to - assuming isotropic shrinkage". This statement is directly derived from the instant disclosed invention, i.e., "enlarged linearily in all directions". It can be seen that the present invention was clearly disclosed and needed and that it differs from any teaching of Wohlwend and Halloran.

Halloran writes "desired sintering density". The Examiner does not acknowledge the fact that Wohlwend doesn't teach anything to what density is being sintered. The Examiner assumes

in view of our invention that Wohlwend is sintering to final density. Wohlwend talks about "porous consistency" (col. 4 line 32) for the working stump / pack but remains unclear about the state of the crown. Halloran states that the sintered density varies from the pore free state (theoretical density) to any chosen degree of residual porosity: Wohlwend offers no teachings and therefore can't guarantee for any dimensional accuracy after sintering. Our claims teach the starting, the final density, the calculus of the enlargement factor and application of the enlargement factor (linear enlargement) all of which is not found in Wohlwend. In summary, the examiner's rejection of the claims as currently pending is based on nothing more than a hindsight reconstruction. The Wohlwend reference now applied was clearly determined by the previous examiner to not teach the present invention. The secondary reference, the letter to Halloran states that the instant application has sufficient disclosure to enable one skilled in the art to make same. The previous Examiner had this document and did not find it to teach the present invention when considered with Wohlwend. There is nothing in either of the references to teach the calculation of an enlargement factor as claimed in the claims of the instant application. The examiner's rejection is nothing more than a hindsight reconstruction and belies the concept of a whole clause of 35 U.S.C. 103.

Appellants have spent numerous sources and efforts in prosecuting the instant application. The reference now applied by the examiner was applied over four years ago in the initial rejection and was distinguished at that time. Appellants respectfully request that the Board of Appeals now look at the "teachings of these references" without the benefit of the teachings of the instant application. Appellants believe that once this is done the Board will clearly see that the prior art

does not teach, suggest, or render obvious the subject matter currently claimed.

CONCLUSION

For the foregoing reasons, the Board is hereby requested to reverse the rejection of claims 16-34 and 41-43 and remand the instant application back to the Primary Examiner for allowance.

APPEAL BRIEF FEE

A check in the amount of $500.00 is enclosed herewith to cover the costs for filing the Appeal Brief. Should the Commissioner determine that an additional fee is due, he is hereby authorized to charge said additional fee to said Deposit Account No. 02-0184.

Respectfully submitted,
Frank Filser et al.

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IN TRIPLICATE

I, Rachel Piscitelli, hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313" on December 6, 2006.

CLAIMS ON APPEAL - APPENDIX A

16. A process for production of an artificial tooth substitute to be fitted on a prepared dental stump comprising the steps of:

(1) selecting a blank of porous ceramic material;

(2) determining a relative density ρ_R and an achievable relative density ρ_S after sintering for the blank of porous ceramic material selected in step (1);

(3) scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;

(4) calculating an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where ρ_R is the relative density and ρ_S is the achievable relative density after sintering determined in step (2);

(5) enlarging the obtained data linearly in all directions by the enlargement factor (f) calculated in step (4) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

(6) transferring the modified data to a control unit of a processing machine;

(7) processing the blank of porous ceramic material selected in step (1) in the processing machine and removing material therefrom to produce a design form of the enlarged model;

(8) sintering the design form of porous ceramic material to obtain a skeletal structure having precise end dimensions; and

(9) facing the skeletal structure as desired to form the

artificial tooth substitute.

17. A process according to claim 16, wherein the artificial tooth substitute is formed with fine run-out margins.

18. A process according to claim 16, wherein the sintering of the enlarged model comprises sintering to a density within the range of 90 to 100% of the achievable relative density.

19. A process according to claim 16, wherein the sintering of the enlarged model comprises sintering to a density within the range of 96 to 100% of the achievable relative density.

20. A process according to claim 16, wherein the sintering of the enlarged model comprises sintering to a density within the range of greater than 99% of the achievable relative density.

21. A process according to claim 16, wherein the blank is a presintered blank of pressed fine ceramic powder.

22. A process according to claim 16, wherein the processing includes processing the blank in a first rough machining and then a second final machining.

23. A process according to claim 16, wherein, prior to the processing, the blank is heat treated at temperatures in the range from 50 to 200°C for a duration of 2 to 20 hours.

24. A process according to claim 16, wherein, prior to the processing, the blank is heat treated at temperatures in the range from 90 to 150°C for a duration of 2 to 6 hours.

25. A process according to claim 23, wherein the processing of the blank into the enlarged model follows the heat treatment.

26. A process according to claim 24, wherein the processing of the blank into the enlarged model follows the heat treatment.

27. A process according to claim 21, including a step of presintering the blank for 0.5 to 6 hours at a temperature of at least 450°C.

28. A process according to claim 16, wherein the ceramic material is selected from the group consisting of Al_2O_3, TiO_2, MgO, Y_2O_3, zircon oxide mixed crystal $Zr_{1-x}Me_x O_{2-(\frac{4n}{2})x}$, and mixture thereof, where Me is a metal which is present in the oxide form as a bi-, tri-, or tetravalant cation ($n = 2, 3, 4$ and $0 \le x \le 1$) and stabilises the tetragonal and/or cubic phase of the zircon oxide.

29. A process according to claim 28, wherein the ceramic material is mixed with an organic binding agent selected from the group consisting of polyvinyl alcohols (PVA), polyacrylic acids (PAA), celluloses, polyethyleneglucols, and mixtures thereof.

30. A process according to claim 29, wherein the proportion of binding agent lies in the range from 0.1 to 45 vol%.

31. A process according to claim 29, wherein the proportion of binding agent lies in the range from 0.1 to 5 vol%.

32. A process for production of an artificial tooth substitute

to be fitted on a prepared dental stump comprising the steps of:

scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;

determining an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where ρ_R is the relative density of a blank and ρ_S is the achievable relative density after sintering;

enlarging the obtained data linearly in all directions by the enlargement factor (f) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

transferring the modified data to a control unit of a processing machine for generating a desired path of a tool;

ceasing scanning and digitizing;

processing a blank of porous ceramic material in the processing machine wherein material is removed by the tool moving along the devised path to produce a design form of the enlarged model;

dense-sintering the design form of porous ceramic material to obtain a skeletal structure having precise end dimensions; and

facing the skeletal structure as desired to form the artificial tooth substitute.

33. A process for production of an artificial tooth substitute to be fitted on a prepared dental stump comprising the steps of:

(1) selecting a blank of porous ceramic material having a relative density ρ_R;

(2) sintering a further piece of the porous ceramic

material under a set of sintering conditions to obtain an achievable relative density ρ_S of the ceramic material after sintering;

(3) scanning and digitizing a three-dimensional outer and inner surface of a positive model of a skeletal structure for the artificial tooth substitute to obtain data;

(4) determining an enlargement factor (f) for the obtained data in accordance with the following

$$f = \sqrt[3]{\frac{\rho_S}{\rho_R}}$$

where ρ_R is the relative density of the preprepared blank and ρ_S is the achievable relative density of the porous ceramic material after sintering obtained in step (2);

(5) enlarging the obtained data linearly in all directions by the enlargement factor (f) thereby compensating precisely for sinter shrinkage to obtain modified data for an enlarged model;

(6) transferring the modified data to a control unit of a processing machine;

(7) processing the blank of porous ceramic material in the processing machine and removing material therefrom to produce a design form of the enlarged model;

(8) sintering under the set of sintering conditions of step (b) the design form of porous ceramic material to obtain a skeletal structure having precise end dimensions; and

(9) facing the skeletal structure as desired to form the artificial tooth substitute.

34. A process according to claim 28, wherein the ceramic material is mixed with an organic binding agent comprising thermoplastics.

41. A process according to claim 16, wherein the enlargement factor is calculated to .000x, where x is an integer.

42. A process according to claim 32, wherein the enlargement factor is calculated to .000x, where x is an integer.

43. A process according to claim 33, wherein the enlargement factor is calculated to .000x, where x is an integer.

EVIDENCE - APPENDIX B

NOT APPLICABLE

RELATED PROCEEDINGS - APPENDIX C

NOT APPLICABLE